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Plant Economics in the Field Museum of Natural History

Charles Frederick Millspaugh

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PLANT ECONOMICS

IN THE

Field Museum of Natural History

CHAS. F. MILLSPAUGH

Chicago, 1910

From the ninth edition of the Guide to the Museum

Department of Botany and Plant Economics.

This department occupies the galleries of the North, South, East (in part) and West Courts of the main building, and may be reached by any of the four flights of stairs near the central rotunda, or by stairways at the ends of the east and west courts.

The intent of this guide is to call attention, in a general way, to the salient points in the Economics of Botany as here installed. No attempt is made to catalogue the contents of the cases, as the labels for each family, group and specimen are full and explanatory. It will be understood that the installation of this great subject is but barely begun despite the fact that it is represented at the present writing by over 300 fully installed cases. Systematic Botany: many whole families; North American Forestry; the great alliances of the fungi, mosses, lichens, algæ (sea weeds), and liver-worts; and many other groupings have not as yet been given place in the installations because of lack of time, space or material.

ARRANGEMENT.

On account of the rapidly increasing collections, and installations, it is impossible at the present time to keep up a purely systematic arrangement of the cases. Those visitors who wish to view the families of plants in systematic order will find references made under each of the family headings, in this guide, to other cases that contain further material in the family.

Location of the Cases.

The cases are plainly numbered in the center of the sash above the glass, and may be found as follows:

Cases.	Location.
Nos. 1 to 99	Encircling the central rotunda.
Nos. 100 to 199	Galleries of the North Court.
Nos. 200 to 299	Galleries of the East Court.
Nos. 300 to 399	Galleries of the South Court.
Nos. 400 to 510	Galleries of the West Court.

The Pine Family (*Pinaceæ*).

(See also cases 446, 447, 448, 449).

Case 1. This case is devoted to an illustrative collection of the fruits (*cones*) of various types of Pines. Observe the pyramidal form characteristic of the as yet unopened cones of the pine, represented by those of the Aleppo Pine (*Pinus halepensis*), and the Larch Pine (*Pinus Laricio*); note also the large opened cones of the Sugar Pine (*Pinus Lambertiana*) and the Georgia Pine (*Pinus palustris*); the characteristic egg-shaped, few-scaled form of the Weeping or Funeral Cypress (*Cupressus funebris*); the closely knit narrow-scaled form of the firs, as shown in the cone of the Red Fir (*Abies magnifica*); the hard woody-scaled fruits of the Virginia Pine (*Pinus pungens*) and the Western Pitch Pine (*Pinus Coulteri*); and the small sprawling-scaled, globe-shaped, nut producing fruits of the Mexican Piñon (*Pinus edulis*).

Case 2.—This case exemplifies seed types and several utilizations of members of the family. Note the three distinct forms of seeds: the nut-like seeds of *Pinus edulis,* the winged seed of the Mountain Pine (*Pinus montana*), and the peculiar elongated form of the edible seed of the Candelabra Pine of Chili (*Araucaria imbricata*). Note the general characters distinguishing the wood of this family as shown in the center of the case; Red Cedar (*Juniperus virginiana*), White Fir (*Abies concolor*), Cypress (*Taxodium distichum*), Douglas Spruce (*Pseudotsuga mucronata*), the Yellow Pine (*Pinus mitis*), the Sugar Pine (*Pinus Lambertiana*), and the Hemlock (*Tsuga canadensis*). The large block of inner bark of the California Red Wood (*Sequoia sempervirens*) indicates the great thickness to which the bark grows, while the walking stick made from it signifies its strength. Instructive examples of the utilization of pine bark as textile material are shown in the Giant Cedar bark of Vancouver Island (*Thuja plicata*).[1] Native uses of pine resins are exemplified in the Ceylon fishing torches formed by wrapping the resin of *Pinus longifolia* in the shredded leaves of the Talipot palm. Three medicinal uses of the Pines are exemplified in specimens of the ground bark of the Hemlock (*Tsuga canadensis*), the

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[1] See also Case 17.

White Pine (*Pinus strobus*), and the young tips of the Savin (*Juniperus Sabina*).

CASES 3 AND 4.—Lower portion. These cases display the Russian method of collecting the oils and resins of the European Pitch Pine (*Pinus sylvestris*). This method consists in stripping off the bark from a large portion of the circumference of the tree and scraping off the exudation. This is continued for a period of five years. Note the original package of pitch scrapings as sold in the native markets; the resin, colophony and "pek," as well as the various products of tapping and of distillation exhibited on the top shelf of these cases. Upper portion. Note the various products of turpentine orcharding from *Pinus palustris* in Georgia, as shown in tubes on the bottom shelf of the top of these cases.

CASE 5.—A temporary installation of the more interesting woods of Palestine many of which are mentioned in the Bible. The Oaks (*Quercus pseudococcifera* and *Q. ægilops*), Pine, Olive (*Olea europæa*) and Plane Tree (*Platanus orientalis*).

CASE 6.—Various pine resins: Mexican "resina" from *Pinus Montezumæ,* Japanese "Chan" from *Pinus densiflora,* "Khasia" from *Pinus khasya* of British India, turpentine from the Indian *Pinus excelsa,* and "trementina" from the Mexican *Pinus teocote.* Amber, a fossilized resin from prehistoric pines, from the newly discovered beds on Staten Island, New York, and an ancient Roman necklace of amber from excavations in Sicily are also exhibited in this case; note also particularly fine natural amber nodules, and a clear, cut piece showing the inclusion of a Caddis fly, from Germany.

CASE 7.—This case contains a complete series of trunks of the Georgia Pine (*Pinus palustris*) showing the destructive method of "boxing" for turpentine and the appearance of the trees in the orchard from the first year's boxing to the fifth year's burning off. This "bleeding" of the trees does not, however, decrease the lumber value, provided the trees are cut soon after the tapping is concluded.

CASE 8.—Base of a Seacoast Pine (*Pinus maritima*) showing the Portugese method of boxing the trunks and collecting the resin. By this method the trees are not substantially injured and the yield of turpentine products, though less each season than under the American method, is perpetual.

CASE 9.—Illustration of the conversion of Spruce pulp from *Picea mariana,* into fibre ware. Note the pulp boards and the examples of the processes necessary to render the pulp impervious.

CASES 10 AND 11.—Upper portion. Exemplification of the conversion of Black Spruce (*Picea mariana*) into the common newspaper stock of today. Note the yellow appearance given to paper by exposure to light. Compare with this the Swedish product from the Norway Spruce (*Picea excelsa*).

CASE 10.—Lower portion. A temporary installation of Japanese wood chip yielded by *Tsuga Sieboldiana* and *Cryptomeria japonica.*

CASE 11.—Lower portion. Vegetable standards and talismans: The wheat of Troyes—Troy weight; the pea of Bayonne; *avoir du pois;* the carat, a seed of the St. John's Bread (*Ceratonia siliqua*); Sesame, the seed of the gingelly oil plant (*Sesamum indicum*); mustard seed, the symbol of insignificance; Damabo (*Rhynchosia cyanosperma*) the weight for gold dust on the African gold Coast; and others.

CASE 12.—Lower portion. Observe the various Japanese utilizations of thin shavings of Hiba (*Thujopsis dolabrata*) and the chip work and twine made from this species.

CASE 13.—Note the paper pulp trees of Japan: Momi (*Abies firma*), Tohi (*Picea Alcockiana*) and Tsuga (*Tsuga Sieboldii*), also paper stock manufactured from the wood fiber.

CASES 14 AND 15.—These cases are devoted to specimens illustrating the conversion of the leaves (needles) of the Georgia Pine (*Pinus palustris*) into textile products; Pine Needle Bagging, Matting, "Hair," Oakum and Antispasmodic Cigars, and the by-products into antiseptic tow and soap.

CASE 16.—Is devoted to various interesting uses of the Giant Cedar (*Thuja plicata*), the inner bark of which is shown as used for making mats, bags, baskets, capes and blankets. The bark is dyed a brownish red with a decoction of Alder bark, or black with iron. Observe Japanese ropes made of the wood of Hinoki (*Thuja obtusa*), and Akamatsu (*Pinus densiflora*). Roof thatching of the bark, and veneer strips of the wood of Sugi (*Cryptomeria japonica*).

Case 17.—Further uses of giant cedar bark; a branch of the common cedar of eastern North America (*Juniperus virginiana*); and a series of specimens illustrative of the manufacture of lead pencils from the wood.

The Olive Family (*Oleaceæ*).

Case 18.—Note that the Olive, the Ash, and the garden Syringa and Privet belong to this family. Note the wood of the Japanese Olive, Hira-gi (*Olea aquifolium*), and the true Olive of the Mediterranean Region (*Olea europea*). Observe Ibota wax or Ibota-ro an insect wax on the Japanese Ash (*Fraxinus pubinervis*), and Clarincillo a similar wax from Mexico. Note the orange-red dye-flowers of Harsinghar (*Nyctanthes arbor-tristis*). Observe a fruiting branch of the Olive, a fine series of Olive oils and Castile soaps from Olive oil.

The Milkwort Family (*Apocynaceæ*).

Case 19.—Stems, fruit and fiber of the wild hemp plant of the American Indians (*Apocynum cannabinum*). The various forms of African and Congo Rubber from the Rubber Vine (*Landolphia owariensis*). Note starch, called "Danish" by the Bahama Negro, a product of the tubers of *Echites umbellata.*

The Gentian Family (*Gentianaceæ*).

Case 19.—Note the various medicinal bases from this family; the North American Buck Bean (*Menyanthes trifoliata*), the American Columbo (*Frasera carolinensis*); and the American Centaury (*Erythrea centaurium*).

The Strychnine Family (*Loganiaceæ*)

Case 19.—A family having many very poisonous members containing strychnine. Note the Dog Buttons, seeds of *Strychnos nux-vomica,* and the gourd of Guianian Arrow Poison, Woorari, of which *S. toxicaria* is one of the principal ingredients. Note also the Yellow Jasmine (*Gelsemium sempervirens*) of the southern United States.

Case 20.—Model of the Indian Corn plant (*Zea Mays*) from a New York State specimen, and above it two large landscapes fashioned from various colored corn husks and "silk."

The Basswood Family (*Tiliaceæ*).

Cases 21 and 22.—A large series of specimens illustrative of the extensive use of Linden Bast (*Tilea europea*) by the peasantry of Russia; note sandals, bags, harness, ropes, boxes, etc. Jute (*Corchorus capsularis*) and its conversion into cordage and textiles.

The Mallow Family (*Malvaceæ*).

Cases 23 and 24.—Various bast fibers from members of this family: the Ceylonese Anoda (*Abutilon asiaticum*), the American Abutilon (*A. avicenne*); the Indian Anodagaha (*A. indicum*) and the Antillean Maholtine (*A. periplocifolium*). Hollyhock fiber (*Althea rosea*) from Italy. Kapukinissa fiber (*Hibiscus angulatus*) from Ceylon; Okra, Vendai or Bandakka fiber (*Hibiscus esculentus*) from the commonly cultivated Gumbo plant, the fruits of which are eaten as a vegetable; Napiretta fiber (*H. furcatus*) from Ceylon; Rose Mallow fiber (*H. moscheutos*) from Louisiana; Majagua fiber from Venezuela, the bast of *Paritium tilaceum* called Bellipapatti in Ceylon; Suriya the fiber of *Thespesia populnea;* Tapkote (*Urena sinuata*) a flax-like fiber of India; and the excellent Aramina fiber (*Urena lobata*) of Brazil, which forms a good substitute for jute.

Cases 25 and 26.—The Cottons (*Gossypium*) of the world and various utilizations of the seed, oil, stem and lint. Note Cotton root extract used in medicine; stem-fiber utilized for coarse bagging; table oil, butter and lard substitute, soap, glycerine, etc.; Celluloid and its imitative character for use in lieu of glass, linen, tortoise shell, jade, onyx, ebony, ivory, etc.

Cases 27 and 28.—An object illustration of the picking, ginning, and cleaning of cotton and the steps necessary in the extraction of Cotton Seed Oil from the seed.

Cases 29 and 30.—The steps necessary in the rendering of cotton absorbent for use in surgical practice. Illustration of each process necessary in the conversion of cotton lint into thread. Above—the various types of cotton cloth and cotton laces. (Compare with Linen in Cases 81 and 82.)

Various Monographic Series.

Cases 31 and 32.—Upper portion. Note the beginning of an installation intended to exemplify the methods adopted by plants for the natural dispersion of their seeds. The installation at this date takes up only dispersion by the wind (*Aerovectence*). Lower portion.—The Plants of the Bible; a long series of Biblical plants with quotations referring to each and descriptions of their characters.

Cases 33 and 34.—A temporary installation of some of the finer blends of Ceylon tea (*Thea sinensis*). The case illustrating tea may be found in the west gallery, north side, No. 484.

Cases 35 and 36.—Upper portion. A series of odd woods showing peculiar arrangement of the wood-cells in geometric forms and various concentric lines.

Case 35.—Lower portion. Observe a monographic assemblage of the ingredients of Ceylon Curry Powder, also a similar assemblage of the ingredients of Betel Chewing substances.

Case 36.—Lower portion. Peculiar aboriginal food stuffs: The nuts of the Western Black Oak (*Quercus Emoryi*) from which the Apache Indians make meal and bread; the fruits of the western Black Walnut (*Juglans californica*) from which the Apaches make a sort of soup; note also a pulp and seed mass from a species of cactus (*Opuntia*) called by these Indians Nanulcage. (See also Case 38.)

Case 37.—Lower portion. A temporary installation of various forms of chocolate. The case illustrating the chocolate plant and its products is (No. 43) two cases further to the south.

Case 38.—Some peculiar foods eaten by various peoples. Japanese Woon or Tengusa, a dried sea-weed (***Gelidium corneum***), and Siamese Agar Agar (***Encheuma spinosa***). Jamaica Flowers (***Hibiscus sabdariffa***) eaten or made into a cooling drink by the Mexicans. Mowha the flowers of an Indian tree (***Bassia latifolia***) eaten like figs to which their taste is comparable; Piñones, the toasted kernels of the Edible Pine (***Pinus edulis***) largely eaten by the Indians of the southwest United States and Mexico; Cassava Bread from the root of the ***Manihot apii;*** Kow Kliep cakes, made of rice flour and teel seed

(*Sesamum orientale*) as eaten in Siam; and Klowlow Niew, a thin cake made of starchy meal from a Siamese tubercus root; exact source at present unknown.

Cases 39 and 40.—Upper portion. A series of varnish, incense and medicinal gums from various countries. Lower portion. Pharmaceutical collection of various gums; showing fracture, guttation and other physical characters necessary to their proper understanding.

Case 41.—Lower portion. Various rubbers from different species and plant families. These gums will be found in duplicate in the families to which they belong.

Case 42.—Lower portion. Various gums, especially Chiclé (*Achras sapota*) from which the greater part of the commercial chewing gums are made. (See also case No. 492.)

The Chocolate Family (*Sterculiaceæ*).

Case 43.—A life-size reproduction of the flowering and fruiting trunk, and a branch of the chocolate tree (*Theobroma cacao*) of South America. Note the enlarged model of a sterculiaceous flower with its peculiar organization for cross fertilization; also the reproduction of an opened fresh chocolate pod and the arrangement of the seeds. Chocolate Fruits and Beans, chocolate nibs, shells (Cocoa), butter, and confection. Note the Swizzle sticks (*Myrodia turbinata*) used by the natives in preparing chocolate as a beverage; also native forms of prepared chocolate.

The Silk-Cotton Family (***Bombacaceæ***).

Case 44.—Right half. Note the seed and bast fibers yielded by species of this family; and the characteristic pod of *Adansonia digitata*. Observe the Natural Oakum, the inner bark of the South American *Ochroma lagopus;* this substance can be used as oakum, for caulking ships, without any treatment. Note the silky coma of the seeds of various species of *Eriodendron* and *Ceiba* useful as stuffing for upholstery.

The Madder Family (***Rubiaceæ***).

(See also Case 496.)

Cases 45 and 46.—The coffees of the world. A large series of typical coffee (*Coffea arabica*) from the various coffee producing districts of both hemispheres. Note the sub-series showing by specimens the process of harvesting, cleaning and separating the berry. A series of the Coffee standards of this country. A series of Coffee extracts. A series of sophisticants and adulterants; Soja beans, split peas, Job's tears, rice, barley, wheat, chicory, etc., toasted for this purpose. A series of mock coffees and coffee substitutes, sometimes termed Health Coffees.

The Tea Family (*Ternstroemiaceæ*).

CASE 47.—A representative series of Japanese Teas (*Thea sinensis*). See also Cases 33 and 34 for Ceylon Teas, and Case 484 for various tea products.

The Holly Family (*Ilicineæ*).

CASE 48.—A long series of the different forms of Maté or Paraguay Tea (*Ilex Maté*) so largely used as a beverage by the peoples of temperate South America.

The Bean Family (*Leguminosæ*).

(See also Cases 57 to 62 and 466 to 473 inclusive.)

CASES 49 AND 50.—The most important varieties of Beans (*Phaseolus* and *Vicia*). A large series of this important nitrogenous food seed.

The Sumac Family (*Anacardiaceæ*).

CASE 51.—An interesting family having many useful and several poisonous members scattered in all climates of the globe. Among them note the Sumacs (*Rhus*), of which the red-fruited species are innocent and the yellow, papery fruited species poisonous. The Japanese Lacquer plant (*Rhus vernicifera*) which yields the poisonous juice so largely used in Japanese art. Note the berries and their resemblance to those of our Poison Sumac of the swamps (*Rhus vernix*), and Poison Ivy (*Rhus radicans*) of the sand lots and dune regions. Note Japanese Wax, Mokuro, from the seeds of the Lacquer tree (*Rhus vernicifera*) and Ju-ro yielded by those of *Rhus suaveolens.* Note the Cashew (*Anacardium occidentale*) an edible fruit (?) with an acrid, poisonous, nut-like seed borne outside; and the Mango (*Mangifera indica*) one of the delicious fruits of the tropics. Note also that Pistach Nuts (*Pis-*

tacia vera) belong to this family, as well as the several fine gums that exude from wounds made on various species.

The Cyrilla Family (*Cyrillaceæ*).

Case 52.—A small family with but little of economic interest among its members. Note the wood of the Leatherwood (*Cyrilla racemiflora*) of the southern United States.

The Bittersweet Family (*Celastraceæ*).

Case 52.—A family of vines or shrubs usually with bright-colored arillaceous fruits of which the Wax Work or Bittersweet Vine (*Celastrus scandens*) is a type. The root of this species is shown as used in medicine. Observe also the root-bark and trunk-bark of the Wahoo or Burning Bush (*Euonymus atropurpureus*) and the fruits of the Bahamian *Elæodendron xylocarpum.*

The Maple Family (*Aceraceæ*).

Case 52.—Note the character of the woods of this family and the winged seeds of the several species. One of the important utilizations of the period is exemplified in the wooden plates, so extensively used by pastry-cooks, market men, and for picnic purposes. Note Maple Sugar and syrup from the vernal sap of the Sugar Maple (*Acer saccharum*). Note also the use of the wood in the manufacture of type and engraver's blocks.

The Laurel Family (*Lauraceæ*).

Cases 53 and 54.—The principal products of this important family of mostly odorous plants are those exemplified in this installation. Observe the various products of the Camphor Tree of China and Japan (*Cinnamomum camphora*), and the method of securing this substance. Note that our common Sassafras belongs to the same natural grouping that includes Cinnamon (*Cinamomum zeylanicum*), and Cassia Bark and Buds from *Cinnamomum cassia.* The principal edible fruit of the family is the tropic Alligator Pear (*Persea gratissima*). Note the various odorous substances yielding oils utilized in perfumery: Puchuri or Sassafras Nuts of Brazil (*Nectandra Puchury-minor*), Benzoin from *Laurus Benzoin* and others.

The Daisy Family (*Compositæ*).

(See also Cases 504 and 505.)

Case 55.—While this great family does not yield utilized products at all in proportion to its large representation in the vegetable world, yet some of them are worthy of mention. Note the various specimens representing Chicory (*Cichorium intybus*) the roots of which serve to sophisticate coffee. Note also the new Colorado Rubber (*Parthenium incanum*), a product of the prairie. Fiber produced from the stalks of the common Burdock (*Arctium lappa*). Various medicinal plants; principally Arnica (*Arnica montana*), Tansy (*Tanacetum vulgare*), Yarrow (*Achillea millefolium*) and Wormwood (*Artemisia absinthium*).

The Castor Bean Family (*Euphorbiaceæ*).

(See also Cases 480 and 481.)

Case 56.—A large family of mostly poisonous plants with milky juice and peculiar beetle-like seeds of which those of the Castor Oil plant (*Ricinus communis*) are typical. Note the extensive series of these oil seeds and oil expressed from the same. Note also the Purging Nut (*Jatropha curcas*). Observe the various forms of meal, flour, and starch of Tapioca, Farinha, Mandioca, and Cassava, from the root of the principal tropic American food plant *Manihot apii.* Note also the forms of Cassava "bread" from this source. Observe Ceara Rubber from *Manihot Glaziovii* and Para Rubber from *Hevea braziliensis.*

The Bean Family (*Leguminosæ*).

(See also Cases 49 and 50 and 466 to 473 inclusive.)

Case 57.—Note Indigo the product of *Indigofera anil;* Tamarinds, the fruit of *Tamarindus indica;* the odorous Tonka Bean (*Dipterix odorata*) with its vanilla-like aroma; Cutch, an extract of *Acacia catechu;* Kudzu Starch from the seed of the Japanese *Pueraria Thunbergiana;* African Cam or Dye Wood (*Baphia nitida*); a number of tan barks and fruits from various species of Acacia, and notably the Tropic American Dividivi (*Cæsalpina coriaria*). Note also the various oils obtained from members of this family, especially the Copaiba Oils from *Copaifera sp.*

CASE 58.—Observe fibers yielded by members of this family: Sunn Hemp by *Crotalaria juncea,* Colorado River Hemp by *Sesbania macrocarpa,* and the Indian Kachnar by *Bauhinia tomentosa.*

CASES 59 AND 60.—Various products of the Bean Family. A complete series illustrating the sources of Licorice, the roots of *Glycyrrhiza glabra.* Algaroba, yielded by *Hymenaea courbaril,* a fossil and recent product utilized in varnish making. Note Chiga starch from the seed of *Campsiandra comosa;* and the characteristic wood in this family.

CASES 61 AND 62.—Various seeds of the Bean Family. Note the wide geographic range of the common Bean (*Phaseolus vulgaris*) and its many color forms. (See also Cases 49 and 50.) Note also that clover, peas, lentils, chick-peas, and vetches belong to this family. Note Fenugreek (*Trigonella foenumgræcum*) the seed that gives the peculiar flavor and odor to Curry Powder (See Case 35), and a fine illustrative series of Gum Arabic the exudation of *Acacia arabica.*

The Rose Family (*Rosaceæ*).

CASES 63 AND 64.—Various seeds and products of the family. Note the family resemblance of the Almond (*Amygdalus communis*) to the "stone" of the Peach (*Amygdalus persica*). Note the tube of Ottar of Roses the oil of the Bulgarian Rose (*Rosa centifolia*). The physical appearance of this costly oil changes daily with the variations in temperature within the case; it solidifies entirely at 57° Fahrenheit. Note the rosary made of the dried "hips" of our common wild rose (*Rosa canina*) thus originating the name "Rosary"; the native candle made of the kernels of the Pigeon Plum (*Chrysobalanus icaco*); the preserved rose petals and dried prune roll of Bulgaria.

Wood Structure.

CASE 65.—A model showing in enlarged detail the structure of the wood of (*Pinus strobus*), with fully explanatory labels.

The Nettle Family (*Urticaceæ*).

(See also Case 460.)

CASES 66 AND 67.—Ramie, the silk-like fibre of *Boehmeria nivea* illustrated by a series of specimens ranging from the stalks to imitation silk objects.

CASE 68.—The Hemp plant (*Cannabis sativa*) and its utilization shown in process steps from the stalk to cordage; Hemp seed and oil; and Gunjah, the dried flowering tops of the Hemp plant as grown in India where they are smoked like tobacco or macerated into Bhang, a highly narcotic intoxicant. Note also Hashish a dark green extract of the tops used as a hypnotic-narcotic and habit drug.

The Mulberry Family (*Moraceæ*).

(See also Cases 87 and 461.)

CASE 69.—Various products of this interesting family. Note the large photograph of a tropic Rubber Tree (*Ficus sp.*) and the peculiar method of rooting downward from the branches, a characteristic feature in this genus. Note the bark of the Paper Mulberry (*Broussonetia papyrifera*) and Japanese paper manufactured therefrom. Observe milk from the Cow Tree (*Brosimum galactodendron*) and Vegetable Cheese made from the same. Note flour and meal from the Bread Fruit Tree (*Artocarpus incisa*); and Central American Rubber from *Castilloa elastica.* Observe Strung Figs from Italy and Preserved Figs from Smyrna both the fruit of *Ficus carica.* Note also Hops the dried strobiles of *Humulus lupulus*; Shellac from *Ficus bengalensis;* and Fustic a yellow dye wood (*Chlorophora tinctoria*).

The Potato Family (*Solanaceæ*).

(See also Cases 497, 498, 499.)

CASES 70 AND 71.—In the table portions are shown a number of forms of manufactured Tobacco (*Nicotiana*) for chewing or smoking.

CASES 72 AND 73.—In the table portions are exhibited a few forms of tobacco leaves and various other tobacco examples.

In the top of these cases are temporarily installed four frames showing in translucent examples, papers made from

Sugar Cane refuse (see Case 107), from the Paper Mulberry (see Case 69) and from the stalk and pith of Indian Corn or Maize (see Case 126). These frames are intended to be reinstalled against windows at some future time.

The Flax Family (*Linaceæ*).

CASES 74 AND 75.—Contain specimens of Flax straw, hackled flax and Flax tow from the chief flax growing regions of the world.

CASE 76.—An old hand flax-brake and two bromide enlargements showing the method of using this implement. Note also the old hackel or heckel used to clean the broken flax and partly straighten the fiber.

CASE 77.—A homemade loom built in 1802, used in the early part of the last century for weaving such fabrics as are shown in Cases 83 and 84.

CASE 78.—Two spinning wheels. The larger, which is known to be over 116 years old, was run by hand power and illustrates the older method of spinning with the aid of the distaff; the smaller one is a more modern, foot-power wheel.

CASES 79 AND 80.—The table part of these cases contains a monographic series of specimens descriptive of the process of securing linen yarns from flax straw. The upright portion is devoted to photographs illustrating the old and the new methods of producing linen.

CASES 81 AND 82.—Specimens of the principal kinds of linen thread of Irish and American manufacture. A series of specimens illustrating the manufacture of linseed oil and oil-cake from the flax seed. Specimens showing the various types of linen cloths and typical linen laces.

CASES 83 AND 84.—American Homespun Linen. Specimens illustrating the early American home manufacture of linen thread and cloth. Note the crude attempt at Damascene. For the finest work in this line see Case 89.

The Clove Family (*Myrtaceæ*).

(See also Cases 488 and 489.)

CASES 85 AND 86.—These cases are devoted to an exemplification of various species of Australian Gum Trees (*Eucalyptus*) their woods, oils, and gums. The woods are hard and enduring, coming into many utilizations; their oils medicinal and utilized in the arts; and their gums (*Kinos*) valuable as tanning substances.

The Mulberry Family (*Moraceæ*).

(See also Cases 69 and 461.)

CASE 87.—Laos paper manufactured by the Siamese from the bark of Khoi (*Streblus asper*), showing the different processes and results, from the bark itself to the peculiar accordion-like Siamese books. Note the black books made from this paper treated with the charcoal of Ton Sanoh (*Aeschynomene indica* of the Bean Family) and used in the native courts of law, being written upon with a cream-colored steatite pencil; which see. Note also fibers and cordage from various species of fig. (See also Case 69.)

The Elm Family (*Ulmaceæ*).

CASE 88.—Note the various seeds of the Elms (*Ulmus*) and compare them with those of the Proteaceæ. Note the utilization of the mucilaginous inner bark of the Slippery Elm (*Ulmus fulva*).

The Protean Family (*Proteaceæ*).

CASE 88.—A family of peculiar plants having their highest development in Australia. Their leaves and fruits show relationship to the Oaks and Elms though they are very characteristic in their differences. Note the peculiar fruits of the various species of Banksia, especially those of *Banksia serrulata,* and observe that the leaves are oak-like, the fruit-body chestnut-like, the fruit-cells Hakea-like, and the seeds Elm-like. Note the peculiar fruits of the Hake Bushes (*Hakea sp.*); the heavy, woody, pear-like fruit of *Xylomelum pyriforme* and its small seed cavity; and the prettily marked wood of the Honeysuckle (*Banksia integrifolia*).

The Flax Family (*Linaceæ*).

CASE 89.—A framed napkin of finest Irish Damascene linen made for the Royal table of Queen Victoria. This exemplifies one of the extreme utilizations of flax as further represented in Cases 74 to 84 inclusive.

The Smartweed Family (*Polygonaceæ*).

Case 90.—Note that Buckwheat (*Fagopyrum esculentum*), Rhubarb (*Rheum rhaponticum*), and Dock (*Rumex crispus*), belong to this family association. Observe the kite made crudely of a single dry leaf of the Sea Grape (*Coccolobis uvifera*).

The Wormseed Family (*Chenopodiaceæ*).

Case 90.—The Sugar Beet (*Beta vulgaris*), showing all the steps in the extraction of sugar from the Beet by 23 distinct specimens representing the result of each process. Of the sugar product of the world (13,957,269 tons) that from the Beet exceeds that from Sugar Cane by over 500,000 tons.

The Poppy Family (*Papaveraceæ*).

Case 91.—The poppy (*Papaver somniferum*) the principal economic plant of this family is represented by a number of specimens showing various interesting products of the plant; Opium, Morphine, Codeine, the capsules from which opium is extracted, the oil of the seed, etc. Note that the Bloodroot (*Sanguinaria canadensis*), formerly used as a red paint (*Puccoon*) by the Indians; Celandine (*Chelidonium majus*) of the gardens, used in medicine; and the Dutchman's Breeches (*Dicentra canadensis*) belong also to the Poppy family.

The Mustard Family (*Cruciferæ*).

Case 91.—Note, from the specimens of seed, how widely Mustard (*Sinapis nigra*) is cultivated in various parts of the world for the oil of the seed. Note also that the Cabbage (*Brassica oleracea*), the Turnip (*Brassica napus*), the Radish (*Raphanus raphanistrum*), and the Horse Radish (*Cochlearia armoraica*) are all members of this family of acrid plants.

The Oak Family (*Fagaceæ*).

Cases 92 and 93.—Various products of the Cork Oak (*Quercus suber*). Observe the bark, or cork peelings of successive periods, and the increase in density and thickness as a result.

Note the finer grades of corks, their velvety surface and lack of holes and cracks; note also the skill with which cork can be carved as shown in the "Cork Picture" of the Doge's Palace, Venice. The utilization of waste cork is also exemplified in many ways.

CASES 94 to 99.—Not yet installed.

Grass Family (*Gramineæ*).

CASE 100.—A fine example of Japanese Bamboo Basketry. This basket is made of the most prized, smoke-stained bamboo, carefully selected as to color. Note the beauty of the band designs, the uniformity of the weave and the symmetry of the whole fabric.

CASES 101 AND 102.—A complete collection of the principal bamboos of Japan. This series was collected and presented to this Museum by the Imperial Japanese Forestry Commission.

CASES 103 AND 104.—An exposition of the major utilized bamboos of Japan. Note the section showing the partitions that, while giving strength to the stems of this giant grass serve to render them readily utilizable as drinking cups, casks, water buckets and bottles, cuspidors, flower pots, vases, and many other containers. Note the brown, smoke-stained bamboo, Susudake (*Bambusa senanensis*) one of the most valued forms; the square bamboo, "Shikaku-take" (*Phyllostachys sp.*), highly valued for ornamental work; the black bamboo "Madake" (*Phyllostachys nigra*), used for screens, fans, and constructive work; the highly elastic "Gomadake" another variety of the same species; and "Yadake" (*Phyllostachys bambusoides*) the original arrow-making bamboo of feudal times.

CASES 105 AND 106.—Various utilizations of grass fibers. Note the utilization of Canebrake (*Arundinaria tecta*) as a fiber-producing grass; the various broom-roots (*Aristida* and *Epicampes*) utilized, as the name indicates, for small brooms and brushes; and the aromatic roots of the India "Khus-khus" (*Andropogon muricatus*) so extensively made into fans and screens which give off a fragrant and cooling odor when sprinkled with water during the heat of the day. A pampas grass fly broom "Escobilla" from Mexico. Observe the interesting Kaya paper, of Formosa, made from *Imperata arundinacea.*

Cases 107 and 108.—Sugar Cane (*Saccharum officinarum*). Bagasse paper manufactured from the refuse canes after the extraction of the juice. Note the native sugars of Peru, Mexico, and Java; the various muscovados and raw sugars; the brown crystal sugar of Peru; the beautiful white crystal sugar of Egypt; rum; alcohol, and vinegar. (Compare beet sugar in Case 90.)

Cases 109 and 110.—Various grains. Note the great variety of grass seeds used as food, and the processes necessary to convert the four principal cereals into food form.

Cases 111 and 112.—The wheats (*Triticum sativum*) of the world. Note the great variety of Russian wheats.

Cases 113 and 114.—Sorghum (*Sorghum saccharatum* and *S. halepense*). Note the Kaffir Corn of Africa; Egyptian Corn, and the "long sweetening" or Sorghum Molasses of the Virginias, Millet (*Panicum miliaceum*). Note the "Rapoko" or "Munga" of Africa and the beautiful millets of Russia. Rice (*Oryza sativa*): note the "Paddy" or unhusked rice of Japan, the whitened rice, red speckled rice, glutinous rice and "puffed rice."

Cases 115 and 116.—The Ryes (*Secale*) and Barleys (*Hordeum*) of the world.

Cases 117 and 118.—The standards of Maize or Indian corn (*Zea mays*) as utilized in governing the sales and shipments of the popped grains: each bottle contains the same number of Case 118 note Maize as grown in various countries of the world. Observe the very large grains of the Andean corn of Ecuador, grown at an altitude of 9,600 feet, and the very small grains of Korea.

Case 119.—The types of Pop Corn (*Zea everta*); note the shape of the kernel and the amount of horny substance. Note the popped grains; each bottle contains the same number of grains thus showing the expansion of the various types.

Case 120.—Sweet Corn (*Zea saccharata*); the specimens show the various standard types of this favorite fresh-food corn.

Case 121.—The types of Dent Corn (*Zea indentata*) the principal fodder, meal, and starch corn. Note that each variety is shown in a manner displaying all of its characteristics of shape, size, grain, tip, butt, and cob.

Case 122.—Types of Flint Corn (*Zea indurata*) are also shown in the right of the case, together with some of the fancy-colored corns of this country.

CASES 123 AND 124.—The Oats (*Avena*) of the world, note the full series of Russian oats and those of Illinois.

CASES 125 AND 126.—Various products of Maize (*Zea mays*); Meal, flour, hominy, cones, grits, and farina. Note the series illustrating the distillation of whiskey; corn feathers (chaff) as a resilient stuffing for cushions. The right of the case is occupied with a full series showing the manufacture of paper from the shives and pith of the cornstalk.

CASES 127 AND 128.—The history of the utilization of Maize as a food. Note the prehistoric corn of the Peruvians, mummy corn, cliff dwellers' and mound builders' corn; the corn "compass" of the Hopi Indians, and the starchy Maize of various colors grown by the southwestern United States tribes of the present day. Note also the various native maize "breads," Mexican "guarditas," "tamales," "tortillas," and Hopi "Piki."

CASE 129.—The utilization of the husks of maize ears as a textile base, and Klickitat Indian bag made from them. Note the use of the pith of cornstalks, compressed into briquettes, as an obtunder for naval vessels. Note also the full series of products and by-products in the manufacture of corn sugar (glucose); oil, rubber, starch, syrup, glucose, "sugar," dextrine, amyline, etc.

CASE 130.—Various utilizations of corn husks. The development and utilization of the "cob" of maize for the manufacture of corncob pipes.

The Palm Family (*Palmeæ*).

(See also Cases 453 to 457 inclusive.)

CASES 131 AND 132.—The creeping palms. Note the full plant of Rattan (*Calamus rotang*) 125 feet long. These rattans often grow to a length of from 200 to 400 feet, spreading over trees and twining in every direction. Note the various grades of rattans used for "cane" work. Note the great fruit of the Ivory Nut Palm (*Phytelephas macrocarpa*); its nuts and their use in simulation of bone buttons.

CASES 133 AND 134.—The natives of Oceania claim that there are as many uses of the Coco as there are days in the year. Some of these uses are illustrated in this Case and in Cases 135 to 138. Various utilizations of the wood, the leaf and the midrib of the Coconut Palm (*Cocos nucifera*). Note the broad board, the house rafter, and eave spout fashioned from this wood; also the brooms, baskets, and ekels from the leaf.

CASES 135 AND 136.—Coir, the fiber surrounding the nut of the Coco Palm, and its utilization for the manufacture of ropes. Note the rope 300 feet long tapering from four inches in diameter to little over a half inch. Coir rope makes the best of all cables for anchoring ship craft, as it is very elastic, acting like a spring, as well as very durable in sea water.

CASES 137 AND 138.—Sections of a coconut tree showing the character of the growth; note the fibrous bundles of the interior and the dense tissue of the exterior. Note further uses of coir in the weaving of mats and bagging, and the coconut leaf skirt of a Sandwich Islander.

CASE 139.—A very large coconut trunk from Trinidad: note the thinness of the bark in proportion to the diameter of the tree.

CASES 140 AND 141.—The utilization of the nut of the Coco palm. Note the various sections of the fruit, showing the proportion of the cavity to the "meat" and "shell" of the nut, and that of the nut to the "husk"; the various uses of the nut meat, and of the mature and immature "shell." Note also sugar, oil, candles, butter, soap, meal, copra, wine, etc.

CASES 142 AND 143.—The Saw Palmetto (*Sabal serrulata*) one of the "Fan Palms" of the southeastern United States. Note the use of cross sections of the "trunk" as brushes; the utilization of the leaf fiber for the same as well as for upholstery material; and that of an extract of the rootstalk for tanning.

CASE 144.—The Cabbage Palmetto (*Sabal palmetto*) in its similar utilization to the preceding species.

CASE 145.—The Bermuda Palm (*Sabal Blackbourniana*) showing the beautiful leaf and its utilization.

CASE 146.—A series representing the Coco de Mer or Double Coconut of the Sechyelles Islands (*Lodoicea sechellarum*) the largest and heaviest of all known fruits.

CASE 147.—Not installed at this writing.

CASES 148 AND 149.—The black palms. Fiber and rope of the Brazilian Piassaba (*Attalea funifera*), with brushes made of the same; flower spathe, fiber and wood of the Black Sugar Palm of Ceylon (*Borassus flabelliformis*); fiber and cordage from the Wine Palm of Ceylon (*Caryota urens*); Javanese Jaggery Sugar from the Jaggery Palm (*Arenga saccharifera*); stripped leaves of the Talipot Palm (*Corypha umbraculifera*) and a Cinghalese book made from the natural leaves of this species; and fiber, cordage, and mat made of the fiber of the Japanese Shuro (*Chamaerops excelsa*).

CASES 150 AND 151.—Devoted to an exposition of various fruits of the palms and their utilizations. Dates, the fruit of the Date Palm (*Phœnix dactylifera*) a noble tree, forty to eighty feet high, invaluable to the desert people of Northern Africa whose most important wants it supplies. Fruits of the Betel Palm of the Indies (*Areca catechu*) a favorite masticatory among the natives. (See also monograph on Betel Chewing, Case 80.) Note wax obtained from the Brazilian Wax Palm (*Copernicia cerifera*). Note also the various sectioned fruits of the Palms and the diverse disposition of the kernels. Palm Oil soap and candles obtained from the African Oil Palm (*Elaeis guineensis*).

Hat Palm Family (*Cyclanthaceæ*).

CASE 152.—Note the split leaf of the Panama-hat "Palm" (*Carludovica palmata*) and the prepared "Jipijapa" for hat making. This is not a true palm but a connecting link between the Palms and the Aroids.

Pondweed Family (*Pontederiaceæ*).

CASE 152.—A small family of water plants no member of which has so far been utilized in the arts or industries of the world.

The Rush Family (*Juncaceæ*).

CASE 152.—Note the "Grass matting" or Rush matting manufactured from the stems (*culms*) of the common rush (*Juncus effusus*).

The Calla Family (*Araceæ*).

CASE 152.—A large family of water-loving plants typified by the common Calla "lily" of the gardens. Note the root of the

Jack-in-the-pulpit (*Arisaema triphyllum*), the Skunk Cabbage (*Spathyema foetida*) and the Sweet Flag (*Acorus calamus*) used in medicine; also starches obtained from the Elephant's Ear (*Colocasia esculenta*).

The Pineapple Family (*Bromeliaceæ*).

CASE 153.—Note the photograph showing the habit, of a large number of the members of this family, of growing upon the branches of trees after the manner of parasites; they are, however, air plants, simply anchored on the trees. Note the "Tumbariche" of Mexico the fruits of *Bromelia pinguin*, small acid "pineapples" used for making a refreshing drink. Note the fiber of various species of Pineapples (*Ananassa*), and that of the Old Man's Beard (*Tillandsia usneoides*) the well known Spanish Moss of the Southern States utilized extensively as a stuffing for mattresses and other upholstery.

The Lily Family (*Liliaceæ*).

CASES 154 AND 155.—Various liliaceous fibers; Bow string Hemp (*Sansevieria guineensis*) with cordage, and an ornamental screen mat of the Ceylonese *S. zeylanica;* the Bear Grass of the southwestern United States (*Yucca filamentosa*) and its fiber; also the fibers of the Spanish Bayonet (*Yucca aloifolia*), Texas Bear Grass (*Dasylirion graminifolium*) and New Zealand Flax (*Phormium tenax*) with their utilizations. Note the utilization of the woody tissue of the Spanish Needle Plant (*Yucca gloriosa*) as splints for surgeons' use; that of the pithy interior of the West Indian Dagger Plant (*Yucca aloifolia*) for razor strops; and a soap made from the pith. Note Sarsaparilla from Brazil (*Smilax Spruceana*) in original bale. Note that onions and garlic belong to the lilies, and the specimens of Ramps (*Allium tricoccum*) the highly odoriferous wild onion used by the mountain people of the Virginias. Observe the medicinal sources of *Trillum, Colchicum,* and *Polygonatum,* as well as the fine specimens of Dragon's Blood (*Draeaena draco*), Soccotrine Aloes (*Aloe succotrina*), and Squills (*Scilla maritima*). Note the peculiar Oil of Garlic (*Allium sativum*); a soap made from a species of *Yucca* in Ecuador; and a Japanese starch obtained from the root of the Dog's-tooth Violet (*Erythronium dens-canis*) used in the manufacture of high-grade confectionery.

The Amaryll Family (*Amaryllidaceæ*).

CASES 156 AND 157.—A leaf model and the fiber of the Yucatan Sisal Hemp or Mexican Grass (*Agave sisalana*) and its conversion into hammocks, binding twine, rope, etc., also as a substitute for Manila Hemp (see Case 160). The fiber of *Agave heteracantha* and its utilization in brush making. Note the beautiful mantilla of Fayal lace (*Agave americana*) as grown in the Canary and Madeira Islands. Observe the various products of juice of the Mexican Pulque Plant (*Agave americana*), honey, whiskey, gin, vinegar, rum, wine and alcohol.

The Sedge Family (*Cyperaceæ*).

CASES 158 AND 159.—The utilization of these common "ditch grasses" in the manufacture of mats, matting, and baskets. Plants of Papyrus (*Cyperus Papyrus*), from Sicily, with modern made papyrus and strips of the pith utilized for making the same; also stalks used in lieu of firewood. The books-of-the-dead in the Egyptian Hall of this Museum were made from this species.

The Banana Family (*Musaceæ*).

CASES 160 AND 161.—This case represents, substantially, the genus *Musa* (the bananas), and their fiber. Note the fine series of Manila hemp (*Musa textilis*) from the Philippine Islands; models of the Banana fruit (*Musa sapientum*) and the Plantain (*Musa paradisiaca*); dried bananas used as a confection in Jamaica; and banana meal, flour and starch, particularly valued as an infant food.

The Yam Family (*Dioscoreaceæ*).

CASE 162.—Note the true Yam (*Dioscorea sativa*) and starch from the same. Also starch from *D. alata* and *D. trifida* of Venezuela. These yams are largely used in lieu of potatoes in the countries in which they grow. (The sweet potato, often called "Yam," is a morning glory tuber, not a true yam.)

The Iris Family (*Iridaceæ*).

CASE 162.—The members of this family have been but little utilized outside of horticulture; note, however, Orris Root (*Iris florentina*) and Blue Flag Root (*Iris versicolor*) from our bogs and ditches.

and the English Walnut (*Juglans regia*) from the hard-shelled natural nut, through many fine thin-shelled grades, to the highly specialized form of California.

The Oak Family (*Fagaceæ*).

(See also Cases 92, 93, 459.)

CASE 167.—The Cork Oak (*Quercus suber*) from Portugal. A very fine and costly decortication of a young tree with three branches. This specimen is considered one of the best examples of dextrous cork peeling ever produced.

CASE 168.—The wood of three species of Japanese oak, Ichigashi (*Quercus gilva*), Akagashi (*Quercus acuta*) and Shirakashi (*Quercus glauca*). Note the fruits (acorns) of various species of oak and their variation of form; also the three species of chestnuts; the Common Chestnut (*Castanea dentata*) the Chinquapin (*Castanea pumila*) and the Spanish Chestnut (*Castanea vulgaris*), also Polente meal and candied chestnuts from Italy. Note that the Beechnut (*Fagus americana*) also belongs to this family.

CASES 169 to 199 not installed at this writing.

DENDROLOGY.

(CASES 200-299 are uninstalled at this writing; they will occupy the galleries of the East Court and contain a comprehensive series of monographs of our North American Trees.)

CASES 300 AND 301.—Russian Oaks (*Quercus pedunculata*) and Ash (*Fraxinus excelsior*) in large and typical trunk and plank specimens.

CASES 302 AND 303.—Russian Birch (*Betula alba*), Poplar (*Populus tremula*) and Elm (*Ulmus campestris*) with sections showing the character of the growth of these species.

CASES 304 AND 305.—Russian Pine (*Pinus sylvestris*).

CASES 306 AND 307.—Russian Spruce Fir (*Picea excelsa*) with various deals and sections of the same.

CASES 308 AND 309.—Formosan woods showing the bark and finish of the various species. Note the similarity of the species to those of Japan. Observe the Ebony (*Diospyros utilis*); the Bischoffia; the Jassamine (*Murraya exotica*); and the Poon (*Calophyllum inophyllum*).

CASES 310 TO 315.—Japanese construction timbers in squares and planks. Note the perfection and beauty of grain in the whole series, especially in the Pine (*Pinus densiflora*); the Arbor Vitae (*Thujopsis dolabrata*); the Cedar (*Cryptomeria japonica*) that gives the peculiar "Japanese odor" to articles that have been packed in cases made of the wood; the Fir (*Abies firma*); the beautiful red Larch (*Larix leptolepis*); the chestnut (*Castanea dentata*); and the Elm-like Keyaki (*Zelkowa keyaki*).

CASES 316 AND 317.—Japanese cabinet timbers. Note the great beauty of all the specimens, but especially the Todo matsu (*Abies sachalinensis*); the Katsura (*Cercidophyllum japonicum*); the Hinoki (*Chamaecyparis obtusa*); the Inu-enju (*Cladastris amurensis*); and the Hari-giri (*Acanthopanax ricinifolium*).

CASES 318 AND 319.—Pyramidal forms showing the growth of seven important Japanese coniferous trees from the base to the apex. The elements of each pyramid show the yearly cubic growth; the total cubic growth; and the perpendicular and horizontal growth in a decade.

CASE 320.—A carved doorway of Vermillion wood (*Pterocarpus indicus*) from the Andaman Islands.

CASES 321 TO 324.—Forty species of Japanese woods, each showing the natural and varnished color and the bark, these are accompanied by Japanese lithographs of the structural characters of the species. The most strikingly beautiful woods here shown may be said to be CASE 321, Araragi (*Taxus cuspidata*), Kaya (*Torreya nucifera*), Kara Matsu (*Larix leptolepis*), and Momi (*Abies firma*); CASE 322, Kuro Matsu (*Pinus Thunbergii*) and Kiri (*Paulowonia imperialis*); CASE 323, Toneriko (*Fraxinus Bungeana*), Kuri (*Castanea vulgaris japonica*) and Shide (*Carpinus laxiflora*); CASE 324, Ichi-gashi (*Quercus gilva*), Aka-gashi (*Q. acuta*), Chan-chin (*Cedrela chinensis*) and Kusu-no-ki (*Cinnamomum camphora*).

CASES 325 AND 326.—Japanese construction timbers. Note the natural beauty of the toko posts (which enter into the construction of all ceremonial tea rooms), especially the Biro (*Livistonia chinensis*), Shide (*Carpinus laxiflora*), Shirakuchi (*Actinidia arguta*) and Yashio-tsutsuji (*Menziesia purpurea*).

CASES 327 AND 328.—A case illustrating the utilization of the bamboo (*Phyllostachys mitis*) in construction. While this gigantic grass can in no wise be classed as a "wood," yet in its utilization it may be considered among timbers.

CASES 329 TO 332.—Ornamental Japanese cabinet woods. Note the great beauty of grain in the five panels of Sugi (*Cryptomeria japonica*): Yuku-sugi chocolate brown from submergence in bog water, wavy sugi and "watered" sugi; note also the rich red-brown Kuwa (*Morus alba stylosa*), the beautiful "old gold" figured Kiwada (*Phellodendron amurense*), the wavy Keyaki (*Zelkowa keyaki*), and the oddly marked Tochi (*Aesculus turbinata*).

CASE 332.—Korean woods. Note that these woods are of the same species as those of Japan.

CASES 333 AND 334.—A circular table top cut from a single board of Padouk (*Pterocarpus indicus*), the tree yielding this board must have been about 10 feet in diameter. Note the carved Blackwood stands (*Dalbergia latifolia*) from Bombay, India.

CASES 335 TO 338.—Cabinet woods of British India. Among the 89 species shown here the most striking may be considered to be: CASE 335, Khovia (*Acacia catechu*), Haladwan (*Adina cordifolia*), Kendu (*Diospyros melanoxylon*) and Shivan (*Gmelina arborea*); CASE 336, Koroi (*Albizzia procera*), Dhoura (*Chloroxylon swietenia*), Sisham (*Dalbergia latifolia*); Tiwas (*D. ougeinensis*) and Nana (*Lagerstroemia microcarpa*); CASE 337, Padauk (*Pterocarpus indicus*); Bibla (*P. marsupium*), Sagum (*Tectonia grandis*) and Sandal (*Santalum album*); CASE 338, Moka (*Schrebera swietenioides*), Kindal (*Terminalia paniculata*), and Jamba (*Xylia dolabriformis*). Note also the trunk of Japanese Boxwood, Tsuge (*Buxus japonica*).

CASES 339 TO 342.—Woods of Johore. Over 200 species: each specimen showing the natural and finished appearance of the wood and the bark.

CASE 342.—Woods of Ceylon. Twenty-one species of Ceylonese woods in excellent examples. Note the beauty of the white Jalotang (*Dyera Neamgayi*); the strong fibered, red, Kapur (*Dryobalanops camphora*); the dense, dark red Rassak (*Vatica rassak*); and the beautifully lined Rungas mango (*Melanorrhoea Wallichii*).

CASES 343 AND 344.—The destructive distillation of wood. These cases illustrate the products obtained through distilling waste Birch, Beech, Maple and Ash wood to obtain wood alcohol and pyroligneous acid.

CASES 400 TO 405.—The woods of Australia. Note the great size, strength and beauty of color in these fine specimens from the Australian forests. CASE 400, Colonial Pine (*Araucaria Cunninghamii*), Negro-head Beech (*Fagus Cunninghamii*) and Bog Onion or Australian Mahogany (*Dysoxylum Fraseranum*); CASE 401, Red Bean or Kidgi-kidji (*D. Muelleri*), a rich red, rosewood-like wood; CASE 402, the white Flindosa or Cudgerie (*Flindersia australis*), the pink She-beech (*Cryptocarya sp.*); CASE 403, a beautiful plank, 4 feet wide, of the "White Beech" or Binburra (*Gmelina Leichhardtii*); CASE 404, note the deep color and fine grain of the Australian Cedar (*Cedrela toona*) and Red Mahogany (*Eucalyptus resinifera*), and the great strength and hardness shown in the specimen of Iron bark (*Eucalyptus paniculata*); CASE 405, note the three Australian Gum woods (*Eucalyptus viminalis, rostrata* and *tereticornis*), and the beautifully mottled Beefwood or Honeysuckle (*Banksia integrifolia*).

CASES 406 AND 407.—These cases are devoted to five fine planks of the Brazilian Pine (*Auaucaria braziliana*) exemplifying its variation in color and grain.

CASES 408 AND 409.—Brazilian timbers; note the beautifully mottled and marked specimens of Laurel (*Nectandra sp.*), the Arkwood (*Tecoma leucoxylon*), the brilliant vermillion Macaca Uba (*Tecoma sp.*), and the Rosewood (*Dalbergia nigra*).

CASES 410 TO 415.—A large series of the timber trees of the State of Paranâ, Brazil, showing the plain and varnished condition and the bark characters of each species. The striking species are: Sassafras (*Mespilodaphne sassafras*) in Case 410; Canillinha Roxa (*Nectandra sp.*) and Quassia (*Quassia amara*) in Case 411; milkwood (*Pao de Leite*) and Corteza Branca (*Bignonia ulignosa*) in Case 412; Congonha (*Ilex congonha*), Marmelleiro Bravo (*Casearia ulmifolia*) and Murteira (*Eugenia lucida*) in Case 413; Araça Piranga (*Psidium acutangulare*) and Canjuza (*Styrax leprosum*) in Case 414; and Cataia (*Myrsine sp.*), Caciperoroca, and Quina vermelha (*Exostemma floribunda*) in Case 415.

CASES 416 TO 429 contain a very characteristic series of the timbers of Paraguay. These are in ample specimens displaying the finished and unfinished wood and the bark.

CASE 416.—Note the beautiful, yellow wood of the Quirandy (*Zanthoxylum sp.*).

CASE 417.—Note the Lignum Vitae or Palo Santo (*Bulnesia sarmienti*) noted for its interlacing tissue, forming wood that is very hard indeed to split or splinter.

CASE 418.—Note the two beautiful red woods Cedro na Pyta (*Trichilia canjerana*) and Quebracho (*Quebrachia balansæ*), the latter of which yields a very valuable tanning kino.

CASE 419.—Observe the peculiar form and structural beauty of the Ivira Pepe Colorado (*Holocalyx balansæ*), a red dye-wood belonging to the Bean Family.

CASE 420.—Note the clear yellow wood of Rabo de Macaco, an unidentified member of the Bean Family and the rose colored, hard wood of Ivira Pyta (*Peltophorum Vogelianum*).

CASE 421.—All the specimens in this case are of more than ordinary interest; the dye-wood Guayacan (*Caesalpina melanocarpa*), the clean, clear, yellow Abati Timbabi (*Hymenaea stilbocarpa*), the dark striped red wood, Curupay (*Piptadenia rigida*) and the similarly marked and colored Curupay Ata (*P. cebil*).

CASE 422.—Note the two bright rose-pink woods Curupay Mi (*Stryphnodendron sp.*) and Curupay Na (*Piptadenia rigida*).

CASE 423.—Note the beautiful, clear white wood of the Palo Blanco (*Calycophyllum multiflorum*) and the two dark red Mesquites: Algarobo negro (*Prosopis nigra*) and Algarobo rojo (*Prosopis sp.*).

CASE 424.—Note the clear, white, firm wood of the white Quebracho (*Aspidospermum quebracho-blanco*).

CASE 425.—The clear, clean, yellow wood of the White Lancewood, Palo de Lanza Blanco (*Myrsine Grisebachii*) and the greenish-brown, hard and firm Lepacho Negro (*Tabebuia flavescens*) are the most striking specimens in this case.

CASES 426 AND 427.—These cases contain several striking and interesting woods, among them the only South American willow (*Salix Humboldtiana*); the Southern Coconut (*Cocos australis*) and the Mora (*Maclura Mora*) one of the valuable South American dye-woods, similar to fustic.

CASES 428 AND 429.—These cases display several tree cross sections which illustrate the density and slowness of growth of several species. Notable in Case 428 is the peculiar cross section of the Ibira Pepe Morati (*Holocalyx balansæ*) and the bright rose-colored wood of Quebracho Rubia, a form of *Quebracho balansæ*. In Case 429 are notable the wood of a great Elder tree

(*Sambucus sp.*) and the very interestingly color-marked Urundey Para, an anacardiaceous species.

CASE 430.—Forty species of woods from the West Indian Island of Trinidad. A series of highly colored and striking woods, among which the following are prominent: Logwood (*Haematoxylon campechianum*), the well known dye; Black Poui (*Tecoma serratifolia*), Red Cedar (*Cedrela odorata*) from which the odorous cigar boxes are usually made; Balsam (*Copaifera officinalis*) the tree yielding balsam of copiava; the deep red Roble (*Platymiscium polystachyum*), and Purple Heart (*Copaifera pubiflora*) a strikingly beautiful deep purple wood.

CASE 431.—A series of thirty-five highly interesting woods from British Guiana, very similar to those from Trinidad. Notable specimens are the orange-red Wallaba (*Eperua falcata*) almost indestructible on account of being surcharged with a natural oil; the yellowish-red Simri (*Hymenaea courbaril*), which yields well known Algaroba varnish resin; the Cedar-like Kurana (*Proteum altissimum*), and Kumara (*Dipterix odorata*) the tree that yields the odorous tonka bean.

CASES 432 AND 433.—Seventy-five of the principal woods of the United States of Colombia. The most attractive of the species displayed are: The bright red Moradillo (*Mimusops Kauki*); Granadillo (*Brya Ebenus*); the bright yellow Guayacan (*Guaicum officinale*) and Naranjillo (*Bravaisia sp.*); the Spanish Cedar (*Cedrela odorissima*); and the yellowish-rose Cumula (*Viburnum sp.*)

CASES 434 AND 435.—These cases contain a very complete and highly authenticated series of the useful woods of Venezuela. The strikingly beautiful species may be considered to be: the black Guayacay (*Guiacum sp.*); Caobano (*Brunellia comocladifolia*); the brilliant red dye wood Braziletto (*Caesalpinia sp.*); the very deep red Pau d'Arco (*Tecoma sp.*); and the brownish-black Ebano (*Caesalpinia Ebano*).

CASES 436 TO 441.—Contain a long series of the woods of the Island of Jamaica. This highly interesting series, botanically speaking, must yet be redressed before the attractive characters of the specimens will become apparent. The great peculiarity at present evident is the strange names that have been given to the trees such as "Milk," "Potato," "Flora," "Big Family," "Beef," "Rosin," "Slug," "Pigeon," "Soap," "Yoke," "Snoop," "May Potter," "Cog," "Salt," "Dago," "Parrot," "Dog," "Fiddle" and "Sarah."

CASES 442 AND 443.—A series of specimens illustrating the testing of timber strength, resistance and elasticity.

The Snakeroot Family (*Aristolochiaceæ*).

CASE 444.—A small family of low herbs and high climbing vines having peculiar trumpet-shaped flowers. Note the singular ribbon-like arrangement of the bundles of wood tissue in the ruptured stem of the Dutchman's Pipe vine (*Aristolochia sipho*), and the peculiar characteristic fruits of the same; note the end section of the yellow dye wood Kalaa, of Siam (*Aristolochia sp.*); note the medicinal roots and stems, all of which are aromatic, tonic and adjuvant and form native remedies for snake-bites.

The Pokeweed Family (*Phytolaccaceæ*).

CASE 444.—The Pokeberry (*Phytolacca decandra*) of North America used as a magenta stain for wood implements, and as an anti-fat remedy. The root is a valuable remedial agent in glandular swellings and in rheumatism.

The Olac Family (*Olacaceæ*).

CASE 444.—Note the West African Oil Nuts (*Heisteria sp.*) and the Casca de Ameixa (*Ximinia americana*), the wood is used as a substitute for sandalwood.

The Sandalwood Family (*Santalaceæ*).

CASE 444.—Section of a sandalwood log showing the character of the tissue and growth; sandalwood sawdust (*Santalum album*) utilized in joss sticks and sachet powders; and Chandan Oil (*Dalbergia Hupeana*), a remedial oil of India.

The Waterlily Family (*Nymphaeaceæ*).

CASE 444.—Note the characteristic fruits of the American Lotus (*Nelumbo lutea*) with the seeds half buried in pits; Lotus seeds eaten by the lotophagi of Siam and Corea; yarn dyed a golden brown with the roots of the British Waterlily (*Castalia alba*) and sections of the tuberous roots of the American Lotus eaten by the Osage Indians.

The Buttercup Family (*Ranunculaceæ*).

CASE 445.—Note the peculiar characteristic fruit of the Virgin's Bower (*Clematis virginiana*) and the various medicinal agents yielded by acrid poisonous members of the family, viz., Aconite (*Aconitum napellus*), Hellebore (*Helleborus niger*), Golden Seal (*Hydrastis canadensis*), Black Cohosh (*Cimicifuga racemosa*) and others. Note that several members yield yellow dyes, such as Hydrastis, and Ispariak (*Delphinium sulphurica*) a yellow rug dye of Turkestan.

The Barberry Family (*Berberidaceæ*).

CASE 445.—The botanical relationship of this family to the Buttercups is shown in the yellow dye products as well as the physiologic action of its drugs. Note May Apple Root (*Podophyllum peltatum*), Blue Cohosh (*Caulophyllum thalictroides*), and Barberry Bark (*Berberis vulgaris*), all well known hepatic remedies; yarn dyed yellow with the latter substance, and Rasaut (*Berberis aristata*) an Indian leather dye.

The Moonseed Family (*Menispermaceæ*).

CASE 445.—Note the consanguinity of this family with the last two in its production of hepatic remedies and yellow dyes. The British India Tree Tumeric (*Coscinium fenestratum*) a yellow dye and stomachic tonic; Pareira (*Cissampelos Pareira*) a tonic and antidote for snakebites; Pareira Brava (*Chondodendron tomentosum*) used for the same purposes in Brazil; Calumba Root (*Jaetorrhiza palmata*) the valuable tropic antidysenterric; and yellow Parilla (*Menispermum canadense*) the hepatic stimulant and tonic of North America.

The Pine Family (*Pinaceæ*).

(Cases 446 to 449, also Cases 1 to 17.)

CASES 446 to 447.—Note the tissue similarity in the various woods yielded by this family of which these cases contain over 60 from various parts of the world. Note the readiness with which the wood splits as seen in the "bundle veneers" of the Japanese Hinoki (*Thuja obtusa*), Momi (*Abies firma*) and Hiba (*Thuja dolabrata*).

CASE 448.—Japanese pine chips, braid and twine products manufactured by shaving Hinoki (*Chamaecyparis obtusa*), Yazomatsu (*Picea ajanensis*), Hiba (*Thujopsis dolabrata*) and Sugi (*Cryptomeria japonica*).

CASE 449.—The fruits (carpology) of the pines. (See also Case 1.) Note the globular cones of the South Sea Pines (*Agathis Moorei, A. vitiensis* and *A. robusta*) and their similarity to those of the Palestine Cedar of Lebanon (*Cedrus Libani*) and to the Candelabra Pine of New Caledonia (*Araucaria Cookii*). Note also the peculiar cones of the Sandarac Trees of New South Wales (*Callitris verrucosa, C. robusta, C. Macleayana* and *C. Muelleri*).

The Yew Family (*Taxaceæ*).

CASE 449.—Note the similarity of the wood of the Yew (*Taxus sps.*) to that of the pine and spruce; also that the yews produce a berry instead of a cone as seen in the Kaya (*Torreya nucifera*) and Maki (*Podocarpus chinensis*) of Japan.

The Cycad Family (*Cycadaceæ*).

CASE 450.—Note that these peculiar, starch-yielding plants bear a connective similarity between the pines, the yews and the palms, as expressed in their cone-like fruits, palm-like leaves and nut-like seeds. The so-called Sago Palm (*Cycas circinnalis*), which yields sago starch, belongs here, also the Florida Coontie Starch plant (*Zamia floridana*).

The Cat-tail Family (*Typhaceæ*).

CASE 450.—Note the baskets, ropes, mats, etc., manufactured from the leaves of the common Cat-tail Flag (*Typha latifolia*) of North America.

The Grass Family (*Gramineæ*).

(See also Cases 100 to 130, inclusive.)

CASE 451.—The utilization of grass stems and fibers. Note the Shepherd's pipe of Sicily made from a reed (*Arundo donax*); reed arrows from the Solomon Islands made of the straight stems of a Plume Grass (*Arundinaria sp.*); straw hat braids from Rye (*Secale cereale*); and Vegetable Horsehair yielded by Esparto Grass (*Stipa tenacissima*).

CASE 452.—Basketry material from grasses: wool yarns dyed light green and brown by the roots of the British Plume Grass (*Phragmites communis*). The various world-wide cereal food grains. Note also the old English confection Barley Sugar.

The Palm Family (*Palmeæ*).

(Cases 453 to 456 and 131 to 151.)

Case 453.—Various basketry, hat and broom fibers extracted from leaves of palms.

Case 454.—Utilization of the wood of palms, bows of the wood of the Sugar Palm (*Arenga saccharifera*) of the Solomon Islands.

Case 455.—Palm hat and mat leaves. Note Cogollo, the principal hat palm of the west coast of South America (*Oreodoxa regia*).

Case 456.—Palm rope fibers. Note the natural saddle pads made of the spathes of an unidentified Mexican palm, and paper stock from the Florida Saw Palmetto (*Sabal serrulata*).

Case 457.—The oils and fruits of palms. Note the carved necklace beads (*Acrocomia sclerocarpa*) from Porto Rico. Dragon's Blood, a medicine and dye resin obtained from the Malagan Deamon Palm (*Daemonerops draco*); and household utensils fashioned from the shells of the Coconut (*Cocos nucifera*).

The Walnut Family (*Juglandaceæ*).

(See also Case 166.)

Case 458.—Note the woods, fruits and dye yielded by this family, especially the pure white wood Sawaguruma (*Pterocarya rhoifolia*) of Japan.

The Birch Family (*Betulaceæ*).

(See also Case 165.)

Case 458.—Observe the model of a magnified portion of the catkins of the male and female White Birch (*Betula alba*) showing the characteristic grouping of the functional structures. Note the peculiar flakes of bark of the Paper Birch (*Betula papyrifera*), and yarns dyed with the bark of the European Alder (*Alnus glutinosa*).

The Oak Family (*Fagaceæ*).

(See also Cases 92, 93, 167, 168.)

Case 459.—Note that the Chestnut (*Castanea americana*) and the Beech (*Fagus americana*) belong with the Oaks; and that various tanning substances and hard charcoals are yielded by members of this family.

The Nettle Family (*Urticaceæ*).

(See also Cases 66, 67, 68.)

CASE 460.—Observe the various forms of Tapa Cloth manufactured by the natives of New Caledonia from the bark of the Paper Mulberry (*Broussonetia papyrifera*).

The Mulberry Family (*Moraceæ*).

(See also Cases 69, 87.)

CASE 461.—Note the fine fiber and cord of Bhang (*Cannabis indica*). Observe that figs (*Ficus carica*) and the Mock Orange (*Toxylon pomiferum*) belong to this family. Note the peculiarly marked Letterwood or Snakewood (*Brosimum aubletii*) from Trinidad, and the pure Caoutchouc yielded by one of the figs (*Ficus elastica*) of Malaya.

The Breadfruit Family (*Artocarpaceæ*).

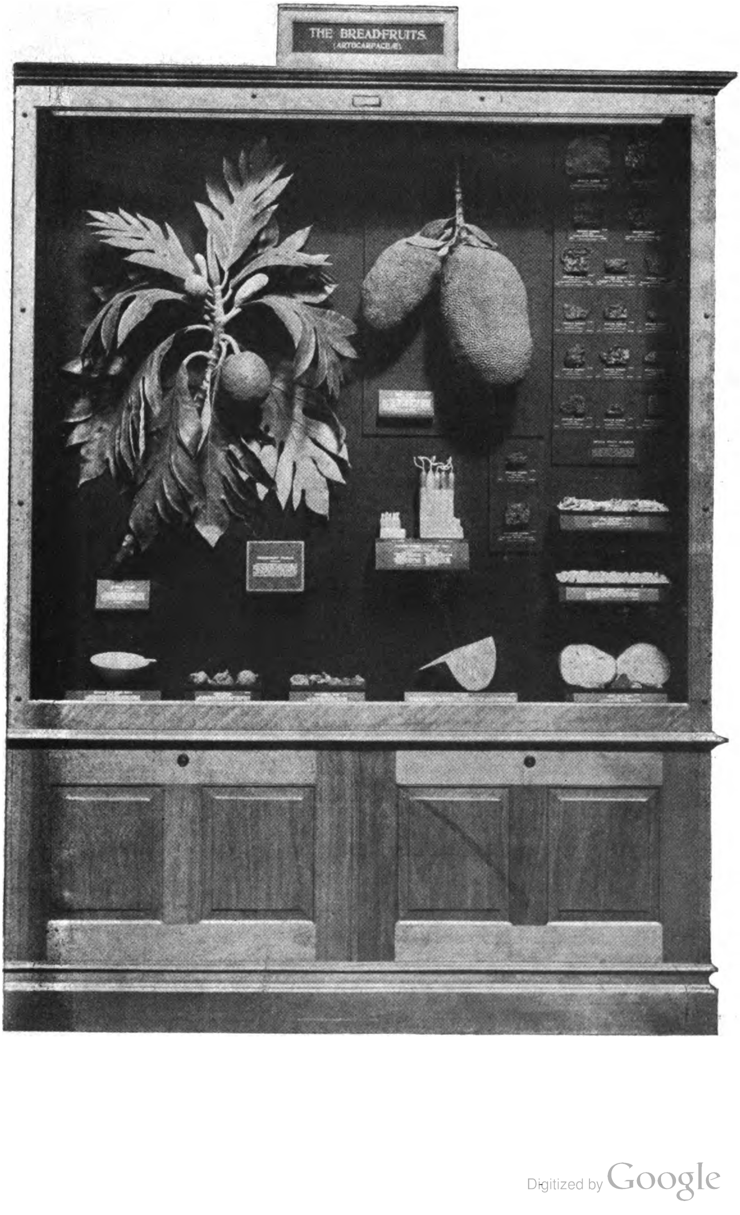
CASE 463.—Observe the natural size reproduction of a branch of the Bread Fruit Tree (*Artocarpus incisa*) in full flower and fruit, also the large fruits of the Jack Fruit (*A. integrifolia*), together with sections of the two fruits showing their pulpy and seed characters, and a model of the magnified male and female flowers. Note the rubbers yielded by *Castilloa lactiflua,* the household Rubber Plant, and Contrayerba (*Dorstenia contrayerba*) a valuable antidote for all kinds of vegetable poisons.

The Magnolia Family (*Magnoliaceæ*).

CASE 464.—Note the peculiar fruits of members of this family and the firm character of the woods and charcoals produced by various species. Also observe the resemblance of the flowers to those of the next family.

The Custard Apple Family (*Anonaceæ*).

CASE 464.—Observe, in the enlarged model of a Custard Apple flower, the thickness of the petals and the peculiar disposition of the essential organs. Note the Malaguita fruits of Colombia (*Xylopia longifolia*) and the models of the Sour Sop


THE BREADFRUITS
(ARTOCARPACEÆ)

(*Anona muricata*) and Sweet Sop (*A. squamosa*), both of Jamaica.

The Witch Hazel Family (*Hamamelidaceæ*).

CASE 465.—Note the Divining Rod and fruiting branch of the Witch Hazel (*Hamamelis virginica*), and the wood and peculiar fruits, as well as the liquid storax yielded by the Sweet Gum (*Liquidambar styraciflua*), also the odd, corky bark of the young twigs of this tree.

The Sycamore Family (*Platanaceæ*).

CASE 465.—Note, in the structural characters of the pendant fruits of the Plane Tree or Button-ball (*Platanus occiaentalis*), the strong resemblance to the fruits of the four preceding families. Note also the beauty of the markings in the "quartered" wood of the species.

The Bean Family (*Leguminosæ*).

(Cases 466 to 473, 49, 50 and 57 to 62.)

CASE 466.—Woods of the Bean Family. The woods of this family are hard, strong, durable and resistant. Note the Wallaba (*Eperua falcata*) naturally impregnated with its oil and thus very durable; the deep red Honey Locust (*Gleditsia triacanthos*) of North America; the clear, yellow Abati Timbati (*Hymenaea stilbocarpa*) of Paraguay, and the peculiar spiral spring-like stem of *Entada scandens.*

CASE 467.—Various products of the Bean Family. Note the very well armed Gorse (*Ulex europaeus*); a pole basket of Hana fiber (*Crotalaria juncea*); Tamarind pulp (*Tamarindus indica*) a refrigerant drink in fever conditions; pure Indigo (*Indigofera anil*) from India; and a fine bundle of characteristic Liquorice root (*Glycyrrhiza glabra*) from Spain.

CASE 468.—Characteristic fruits of the Bean Family. Note the flat scimitar-shaped pods of the Royal Poinciana Tree (*Poinciana regia*) of Africa, *Entada scandens* from Brazil and the Bay Bean (*Canavalia sp.*) from Paraguay; the round scimitar pods of the Cassia (*Cassia grandis* and *C. fistula*); the bean-like fruits of the Tamarind, and St. John's Bread (*Ceratonia siliqua*); the broadly flat pods of the Kentucky Coffee Tree (*Gymnocladus dioica*), and the sweet smelling Tonka Bean (*Dipteryx odorata*);

the spiny fruits of the Gray and Yellow Nickers (*Guilandina crista* and *G. bonducella*); the peculiar, twisted, flat, blue pods of Timbo Morati (*Enterolobium sp.*), and many others.

CASE 469.—Seeds of the Bean Family. Note the similarity of the various seeds of this family to those of the common table bean. Examine the very poisonous Ordeal Bean of Old Calabar (*Physostigma venenata*); the Tahiti Chestnuts (*Inocarpus edulis*); the beautiful blue Damabo Bean (*Rhynchosia cyanosperma*) used as a weight for gold dust on the African Gold Coast; the Ox Eye Beans (*Dolichos sp.*) of South America, utilized, by inlaying, for watch charms by jewelers; the peculiar angular pods of the Soap Fruit of Africa (*Tetrapelura Thonningii*); the tanning fruits Algarobilla (*Prosopis sp.*) and Divi Divi (*Caesalpinia coriaria*) of the West Indies, and many other useful seeds.

CASE 470.—The Pea Nut (*Arachis hypogaea*) in its various forms and qualities; soap and candles made from the oil; various nut foods used as substitutes for meat; and a fruiting plant upset to illustrate the peculiar habit of this plant of maturing its fruit beneath the ground.

CASE 471.—Exhibits a long series of the useful gums yielded by the Bean Family. Note the valuable varnish gum Algarrobo, Corobore, Jatoba, Gum Anime or Locust Gum, the recent and fossil product of the South American Locust (*Hymenaea courbaril*); the beautiful, clear white Gum Tragacanth (*Astragalus leiocladus*) of Persia; the clear yellow Mesquite Gum (*Prosopis juliflora*) of the Southwestern States; the Persian Babul or Gum Arabic (*Acacia arabica*), and many others of beauty and value.

CASES 472 AND 473.—The tan and dye barks of the Bean Family. These are mostly the barks of various Acacia trees high in the yield of tannic acid. Note especially the Australian Wattle Barks (*Acacia decurrens, A. Maidenii, A. armata, A. dealbata, A. neriifolia, A. pycnantha, A. pruniosa, A. falcata*). The dye woods: Cam-wood (*Baphia nitida*) of West Africa, Sappan-wood (*Caesalpinia Sappan*), Log-wood (*Haematoxylon campechianum*) and others.

The Mahogany Family (*Meliaceæ*).

CASE 474.—Note the fruit forms in this family as represented by that of the Mahogany (*Swietenia mahogani*); Spanish Cedar

(*Cedrela odorata*), the fluted Aglaia (*Aglaia sp.*), and the Star-shaped Leopard Tree fruit (*Flindersia australis*) from New South Wales. Note the various gums, and Crab Oil from the seeds of the Crabwood (*Carapa guianensis*) of South America, used as an illuminating and healing oil.

CASE 475.—Note the various tanning barks and mahoganies, especially Honduras Mahogany (*Swietenia mahogani*) and the Spanish or Cigarbox Cedar (*Cedrela odorata*); also the Carapa shingles (*Carapa guianensis*) which are very resistant to the weather on account of the oil with which they are naturally saturated.

The Rue Family (*Rutaceæ*).

CASE 476.—Note the model of the Grape Fruit (*Citrus decumana*) blossom giving the full characters of the Orange flowers, especially the oil dots that appear upon various parts of the flower. Note the jewel box made from the rind of the Bergamont fruit (*Citrus bergamena*), and the Indian Bel fruit (*Aegle marmelos*) known also as the Bengal Quince, a fruit delicious in taste and exquisite in fragrance, yielded by the most sacred of all Indian trees. Note the preserved Orange flowers (*Citrus aurantium*), a Persian sweetmeat, and the fruit and wood of the Chinese Cork Tree (*Phellodendron amurensis*) now being planted to some extent in this country.

CASE 477.—Note the various barks utilized as antidysenterric remedies, and the peculiar, warty bark of various trees known as Hercules' Clubs (*Xanthoxylum sps.*).

The Papaw Family (*Caricaceæ*).

CASE 478.—Note that the pawpaw of the United States does not belong to this family, but to the Custard Apples (Case 464). The papaw of the American tropics (*Carica papaya*) is the well known fruit that yields Vegetable Pepsin. The fruit is shown, in section, in this case. Note the beautiful glass model of a complete cluster of male flowers, and the wax and glass models of both the male and the female flowers enlarged.

The Incense Family (*Burseraceæ*).

CASE 479.—A small family of tropic trees and shrubs, most of which yield a more or less aromatic gum. Note Gum Olibanum

(*Boswellia papyrifera*), Myrrh (*Balsamodendron myrrh*) and Bdellium (*Commiphora Hotai*) incense gums of Biblical fame. Caraña (*Protium carana*), a South American gum used as a healing salve; Copal (*Bursera excelsa*) a Mexican varnish gum, and others. Observe the very sweetly odorous wood Linaloa (*Bursera Dalpechiana*) of Mexico.

The Quassia Family (*Simarubaceæ*).

CASE 479.—A family of mostly bitter plants noted for their tonic effect upon the digestive tract. Note the fruits of the Tree of Heaven (*Ailanthus glandulosus*); the yellow wood Quassia (*Picrasma excelsa*) and drinking cups made of the same in which water becomes bitter the moment it is poured in them.

The Spurge Family (*Euphorbiaceæ*).

(See also Case 56.)

CASES 480 AND 481.—Note the various forms of Castor Oil from the tropical Castor Oil Bean (*Ricinus communis*) a cluster of which may be seen in the lower left corner of the case. Observe the highly explosive fruits of the Sandbox Tree of South America (*Hura crepitans*) and the oil, soap and candles made from the Purging Nut (*Jatropha curcas*).

CASE 481.—Observe Cassava and Tapioca from the root of the tropic American Cassava (*Manihot apii*) and the long series of Para Rubber from the American Rubber Tree (*Hevea brasiliensis*).

The Soapwort Family (*Sapindaceæ*).

CASE 482.—Note the peculiarities in the floral structure in this family as seen in the model of an enlarged flower of the Akee (*Blighia sapida*), and the peculiar form of the climbing stems of many species in this family. Note the Soap Berry (*Sapindus divaricata*) used in the tropics in lieu of soap, and Shellac deposited upon the stems of the Indian *Schleichera trijuga* (see also the bottom shelf of the next case 483).

The Horsechestnut Family (*Hippocastanaceæ*).

CASE 482.—Note the large fruits and nuts of the Buckeyes (*Aesculus glabra* and *A. hippocastanum*), and the wood of Tochi-no-ki (*A. turbinata*) of Japan.

The Buckthorn Family (*Rhamnaceæ*).

CASE 483.—Note the gums, dyes and fruits of this family: the Christ's Thorn (*Paliurus spini-Christi*) of Palestine, supposed to be the thorn that formed the crown at the crucifixion; Jujube Berries and gum (*Zizyphus jujuba*), the berries are known as Chinese Dates and are eaten fresh or dried.. Buckthorn Berries (*Rhamnus catharticus*) from which the water color "sap green" is extracted; yarns dyed yellow and brown with the bark of the British Buckthorn (*R. frangula*); and Kemponashi (*Hovenia dulcis*) an interesting wood utilized by the Japanese for fancy cabinetry.

The Vine Family (*Vitaceæ*).

CASE 483.—Note the grapes and raisins produced by this family: Argols, the basis of baking powders, deposited on the inner surfaces of wine casks; grape sugar, a natural glucose from grapes; and note that the common dried "currants" or Zanté currant is not a currant, but a small seedless grape from Corinth, Greece (*Vitis carinthiaca*).

The Souarinut Family (*Caryocaraceæ*).

CASE 484.—Souari Nuts (*Caryocar nuciferum*) from British Guiana, said to be the most delicious of all nuts, and oil extracted from the kernels; Picuy, Pikia or Ouricori Oil from the kernels of *C. butyrosa.*

The Tea Family (*Theaceæ*).

(See also Cases 33, 34, 47.)

CASE 484.—Various types of teas, many of them very fine and costly. Note the gold and the silver tips (young leaves gathered before unfolding), also tea grown in South Carolina; soluble tea; and Brick Tea eaten in Thibet boiled like potherb. Note the wood of this family represented by Mokkoku (*Camellia japonica*).

The Wingedfruit Family (*Dipterocarpaceæ*).

CASE 485.—Note the resins yielded by various species in this family: Sal (*Shorea robusta*) an aphrodisiac gum of India; Doona Gum (*Doona trapezifolia*), and Hal Gum or Piney Resin from *Vateria acuminata,* both valuable varnish gums; and In Oil from the seeds of *Dipterocarpus glandulosus,* a valuable waterproofing for buckets and other conveyors.

The Vegetable Tallow Family (*Guttiferæ*).

CASE 485.—A family peculiar in its yield of vegetable tallows, butters and greases. Note Kokam Butter from the seeds of the Indian *Garcinia indica;* Vegetable Grease from the kernels of the African *Allamblackia Stuhlmanni;* the seeds of the Tallow Tree of Sierra Leone (*Pentadesma butyracea*) the fruits of which yield an edible tallow; note other oils and gums and the Mangosteen (*Garcinia mangostena*) esteemed as the choicest of all fruits.

The Arnatto Family (*Bixaceæ*).

CASE 485.—Note the seeds, fruits and extract of the Butter Color Tree (*Bixa orellana*) of South America.

The Passionflower Family (*Passifloraceæ*).

CASE 486.—Note that the fruits of several species of passionflowers are edible, especially the Grenadilla (*Passiflora edulis*) of Central and South America.

The Cactus Family (*Cactaceæ*).

CASE 486.—Note the various forms of cactus: the cochineel bugs and extract; the model of an edible cactus fruit (*Opuntia Toona*); and candy made of the pith of *Echinocactus Emoryi* the horribly spined form shown on the second shelf above.

The Leatherwood Family (*Thymelaeaceæ*).

CASE 486.—Note the beautiful lace-like inner bark of the Lacebark (*Lagetta lintearia*) of the West Indies, and whip and doileys made of the same; note Moose-wood (*Dirca palustris*) the bark of which was utilized by the American Indians for thongs.

The Pomegranate Family (*Punicaceæ*).

CASE 487.—A family composed of two species only, both yielding edible fruit. The Pomegranate (*Punica granatum*), of the oriental tropics, an acid fruit with a very astringent rind used for tanning. The flowers are used as an astringent medicine and as a dye.

The Mangrove Family (*Rhizophoraceæ*).

CASE 487.—The common mangrove of all low, muddy, tropic sea coasts (*Rhizophora mangle*). The bark is highly tannic and valuable as a tanning substance.

The Combretum Family (*Combretaceæ*).

CASE 487.—A small family the peculiar fruits of which form valuable mordaunts, dyes and tans. Note Harra fruit (*Terminalia chebula*), Bahera Fruit (*T. belerica*) and Arjuna fruit (*T. arjuna*) all Indian myrobalans; also Dengoo fruit (*T. sp.*) from Johore, and Kahata (*Careya arborea*) from Ceylon. Note also the anti-opiate plant *Combretum sundaicum* from the Straits Settlements.

The Monkeynut Family (*Lecythidaceæ*).

CASE 488.—Note the peculiar fruits of this family having their opening closed by a plug until ripe, and the heterogeneous disposition of the seeds (nuts) within the fruits. Sapucaya Nuts (*Lecythis Zabucaya*) a delicious nut of the Orinoco and Amazonian regions; Monkey Pots and Nuts (*L. ollaria*), and the Brazil Nut or Nigger Toe (*Bertholletia excelsa*) the rich, edible nut of one of the tallest of the Amazonian trees. Observe Wina fiber, the excellent, thin bast of *Lecthis pisonis* of Brazil.

The Clove Family (*Myrtaceæ*).

(See also Cases 85, 86.)

CASE 489.—Note Cloves (*Caryophyllus aromaticus*) the dried flower buds of a small Malayan tree, and Allspice (*Pimenta officinalis*) the fruit of a large tree known to grow only on the Island of Jamaica. Observe the various tanning and astringent medicinal barks yielded by members of this family; and the Guava (*Psidium guava*) the celebrated preserve fruit of the West Indies.

The Parsley Family (*Umbelliferæ*).

CASE 490.—A large family of strongly odorous plants yielding many aromatic stomachic remedies and several virulent poisonous plants. Note Celery seed (*Apium graveolens*), Parsley (*Petroselinum sativum*), Carrots (*Daucus carota*); Anise, Coriander, Dill, Fennel and Cumin seeds, all well known condiments producing highly aromatic essential oils; Asafoetida, the concrete exudation of the roots of the Persian *Ferula assafoetida,* and Gum Ammoniacum that flows from insect punctures in the flowering stem of the Oriental *Dorema ammoniacum,* a tall parsley-like plant.

The Dogwood Family (*Cornaceæ*).

CASE 491.—A type of this family is the Flowering Dogwood (*Cornus florida*) the dense wood of which is known as American Boxwood from its utilization for printers' woodcuts. Note the Ogechee Limes or Tupelo Gum Fruits (*Nyssa aquatica*) eaten as a preserve in the Southern States.

The Wintergreen Family (*Ericaceæ*).

CASE 491.—A family of more or less aromatic plants, several of which find use in domestic medicine. Note the yarn dyed by the English Heather (*Calluna vulgaris*), and the density of the wood in this family as shown in the cross section of the Japanese Yashio t'sut'suji (*Menziesia purpurea*).

The Myrsine Family (*Myrsinaceæ*).

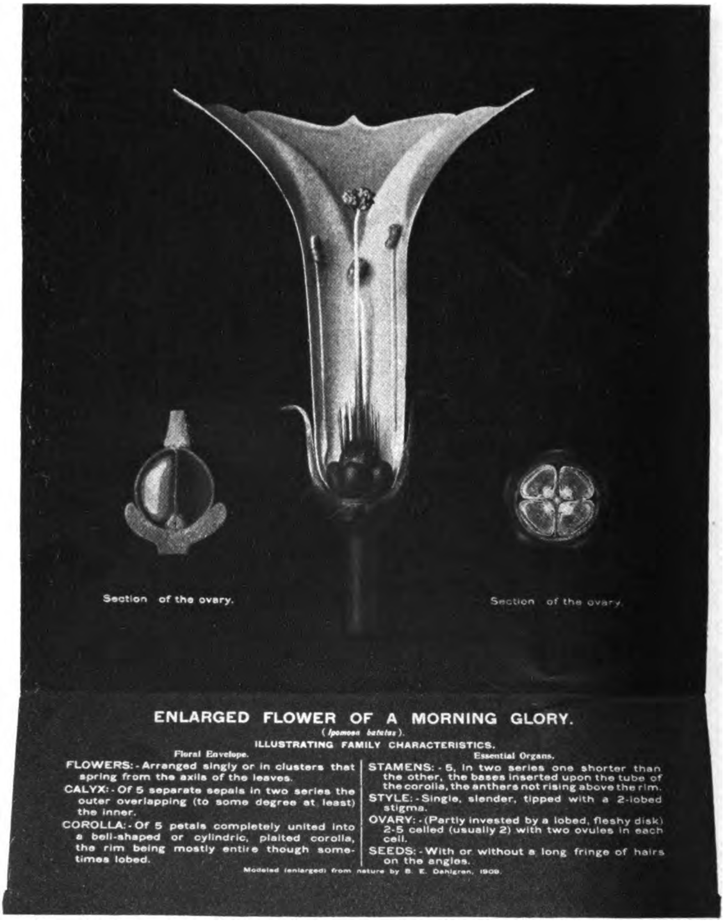
CASE 491.—A small family of tropic trees yielding little of economic importance except their lumber. Note the density and beauty of the wood as evident in the specimens of Lancewood (*Myrsine Grisebachii*) and Canelon (*M. floribunda*).

The Styrax Family (*Styracaceæ*).

CASE 491.—A small family of woody plants, several of which yield odorous incense gums. Note Sumatra Benzoin exuded by a small tree of Sumatra (*Styrax subdenticulata*), and Gum Benjamin, a similar resin exuded by the Malayan *S. Benzoin.*

The Sapodilla Family (*Sapotaceæ*).

CASE 492.—A small family of chiefly tropic and subtropic trees and shrubs having a milky juice, many of which yield delicious, edible fruits. Note the Star Apples (*Chrysophyllum cainito*), the Chinese Litchi (*Nephelium litchi*), and Formosan Longan (*N. longan*), the Mexican Mamme (*Lucuma mammosa*) and especially the Central American Sapoté (*Achras sapota*) the congealed milk (chiclé) of which forms the basis of most of the chewing gums.



ENLARGED FLOWER OF A MORNING GLORY.

(*Ipomoea batatas*).

ILLUSTRATING FAMILY CHARACTERISTICS.

Floral Envelope.

FLOWERS:- Arranged singly or in clusters that spring from the axils of the leaves.

CALYX:- Of 5 separate sepals in two series the outer overlapping (to some degree at least) the inner.

COROLLA:- Of 5 petals completely united into a bell-shaped or cylindric, plaited corolla, the rim being mostly entire though sometimes lobed.

Essential Organs.

STAMENS:- 5, in two series one shorter than the other, the bases inserted upon the tube of the corolla, the anthers not rising above the rim.

STYLE:- Single, slender, tipped with a 2-lobed stigma.

OVARY:- (Partly invested by a lobed, fleshy disk) 2-5 celled (usually 2) with two ovules in each cell.

SEEDS:- With or without a long fringe of hairs on the angles.

Modeled (enlarged) from nature by B. E. Dahlgren, 1909.

The Ebony Family (*Ebenaceæ*).

CASE 492.—A small family of shrubs or trees bearing a more or less globular fruit. Note that the Persimmon (*Diospyros virginiana*) belongs to this family; observe the dried and preserved fruits of this well known tree of the central and southern states. Note Keg Figs, the dried fruit of the Korean *Diospyros Kaki* and the wood from Japan; also Japanese Ebony (*Diospyros lotus*).

The Morning Glory Family (*Convolvulaceæ*).

CASE 493.—A small and closely allied family of mostly twining plants typified by the common Morning Glory (*Ipomoea violacea*); observe the complete reproduction of a Sweet Potato plant (*Ipomoea Batatas*) from Jamaica, and the enlarged sectional model of the flower and its ovary. Note the tuberous roots, the characteristic stems and fruits, and the starches from other members of the family.

The Milkweed Family (*Asclepiadaceæ*).

CASE 494.—Note the peculiar twin fruits of this family as represented by those of the Common Milkweed (*Asclepias cornuta*) and the silky coma of the seeds. Note the Apples of Sodom (*Callotropis procera*), "They turn to dust and ashes," and the fruit of the Giant Milkweed (*C. gigantea*).

The Verbena Family (*Verbenaceæ*).

CASE 494.—Observe the character of the fruits as seen in the Monks Pepper (*Vitex agnus-castus*) and the dense resistant wood exemplified by Teak (*Tectonia grandis*) the valuable ship timber of India. Note also the various drugs yielded by several members of the family.

The Mint Family (*Labiateæ*).

CASE 495.—A well known family of square-stemmed herbs typified by the common Peppermint (*Mentha piperita*) which yields a valuable aromatic essential oil and the crystalline substance menthol which see. Note Pennyroyal, Lavender, Sage, Thyme, Catnip, Horehound and Summer Savory, all aromatic flavoring plants employed in cookery and medicine.

The Sesame Family (*Pedaliaceæ*).

CASE 495.—Note the oriental Sesamé, Gingelli, Teel or Benny Seed (*Sesamum indicum*) and the valuable oil and food confections made from the same.

The Madder Family (*Rubiaceæ*).

(See also Cases 45, 46.)

CASE 496.—Note that Coffee (*Coffea arabica*) and Quinine (*Cinchona officinalis*) are members of this family. Note Madder (*Rubia tinctoria*) and yarns dyed by its roots, note also the yarns dyed by the roots of the common Bedstraw or Cleavers (*Galium verum*) of Europe and North America.

The Potato Family (*Solanaceæ*).

(See also Cases 70, 71, 72, 73.)

CASE 497.—Note the many poisonous plants used in medicine, viz., Belladonna (*Atropa belladonna*), Stramonium (*Datura Stramonium*), Henbane (*Hyoscyamus niger*) and Bittersweet (*Solanum Dulcamara*); and that the Potato, Egg Plant, Tomato and Tobacco belong to this family. Note the so-called Frozen Potatoes of Bolivia and Chile, and the Fruits of the Vine of Sodom of the plains of Jericho (*Solanum coagulans*).

CASES 498 AND 499.—Typical examples of various Tobaccos (*Nicotiana sps.*) from many parts of the world. Note the peculiar commercial forms from East Africa, Hayti, Ceylon, Egypt, Mexico and Guatemala; also the fine examples from Bulgaria, Russia, Japan, Virginia and Kentucky.

The Snapdragon Family (*Scrophulariaceæ*).

CASE 500.—Note the winged seeds of the family as represented by those of the valuable heart stimulant Digitalis (*Digitalis purpurea*) and their resemblance to the seeds of the next family. Note other medicinal agents yielded by this family and the wood of the Pride of China Tree (*Paulownia imperialis*) now planted to considerable extent in this country.

The Trumpet Flower Family (*Bignoniaceæ*).

CASE 500.—Observe the fruits in this family as represented by those of the Catalpa Tree or Indian Bean (*Catalpa bignoni-*

oides), the What-o-Clock (*Jacaranda caerulea*) of the Bahama Islands, and the Nymph's Comb (*Pithecoctenium Aubletii*) of Central America. Note in the latter fruit, the beautiful winged seeds (see also Case 31) and the extraordinary manner of their "packing" in the fruit. Note also Calabashes, the highly useful fruits of the Calabash Tree (*Crescentia Cujete*) of the American tropics, and the long, thin, bast fiber Tanary from the inner bark of *Tecoma leucoxylon* used in Brazil in lieu of paper.

The Elder Family (*Caprifoliaceæ*).

Case 502.—Observe the berry-like fruits, characterizing this family, as represented by Coralberry (*Symphoricarpos symphoricarpos*) and Laurestinus (*Viburnum tinus*). Note the medicinal barks and roots; yarns dyed green by the fresh berries of the European Elder (*Sambucus nigra*); and the dried flowers of the American Elder (*S. canadensis*) used as an infantile remedy.

The Teasel Family (*Dipsacaceæ*).

Case 502.—Note the cylindric, prickly fruits of the Teasel (*Dipsacus sylvestris*), formerly utilized to a very large extent in "carding" wool for spinning.

The Valerian Family (*Valerianaceæ*).

Case 502.—Note the various forms of Valerian, the root of several species of *Valeriana*, a noted remedy for hysteria and spasmodic attacks.

The Melon Family (*Cucurbitaceæ*).

Cases 502 and 503.—A large family of twining or climbing tendril-bearing plants characterized by the Squash, Pumpkin, Melon and Cucumber plants. Note the mostly globular fruits of the family as exemplified in the Balsam Apple (*Micrampelis lobata*) of our hedge rows and waste grounds, and the characteristic oval, flat seeds shown in many species. Note the Colocynth Apples (*Citrullus colocynthis*) a valuable drug from Africa; the vegetable Sponges (*Luffa cylindrica*); and the examples of varied uses of the cellular fiber; and the thick, oily seeds of the Secua (*Fevillea trilobata*) and Canole (*F. scandens*) of northern South America.

The Daisy Family (*Compositæ*).

(See also Case 55.)

Cases 504 and 505.—Note that though this is one of the largest of all families of flowering plants, embracing over 12,000 species, yet their utilitarian character is very slight. Observe, however, the large number of bitter medicinal plants, among which Boneset, Elecampane, Chamomile, Dandelion, Tansy, Feverfew, Wormwood and Arnica are well known household medicaments. Note yarns dyed yellow by tinctures of several plants of this family, and that Saffron for dyeing pink or rose color is yielded by the petals of *Carthamnus tinctorius*.

PEAT.

Case 506.—Peat, the dead and partly decomposed roots of grasses, sedges and often Sphagnum or Mosses, and its various utilizations. Note the fuel, charcoal, torches, oakum, twine, cloth, paper, etc., made from this substance.

PETRIFACTIONS.

Case 507.—Fossil woods and gums. Note the Onyxized Wood from the petrified forest of Arizona; the petrified Sugi from Japan and tray carved from the same; and the fossil oak found so frequently in excavations under Chicago.

THE STUDY COLLECTIONS.

A full series of duplicates of the specimens displayed in each case is preserved in the lockers beneath it. While these collections are secluded, they are at all times at the service of any visitor who desires to examine more intimately any object of special interest. A member of the Department staff will be detailed to open any locker desired, and give such further information as may be possible concerning the specimens, on application to the Curator at his office in the northeast corner of the North Gallery.

THE HERBARIUM.

The Herbarium of the Department is located in the balcony above the North Transept Gallery. It contains about 400,000 mounted plants, and is especially rich in plants of Illinois, Mexico, the Antilles, and the Bahamian Archipelago. These collections are open to specialists and students in Botany at any time, and also to those visitors who desire to examine them. Application should be made to the Curator as stated above.